

[illegible]

1. A method of improving the high current operation of a transistor circuit formed in a semiconductor substrate comprising the steps of:
- forming a collector region extending downward from the surface of the substrate by introducing an impurity which promotes one of either holes or electrons as a majority carrier into the substrate which is generally doped with an impurity which promotes the other type of carrier as a majority carrier;
- forming a base region extending downward from the surface of the substrate into a portion of the collector region by introducing the other type of carrier into said base region;
- forming an emitter opening on top of said base region, smaller than the surface area of said base;
- forming an area of the collector horizontally adjacent said base region having an increased collector doping, and having an effective horizontal area greater than the surface area of the emitter opening, but less than the area of the base which is horizontally adjacent said collector.
2. The method of claim 1 and further comprising the step of:
- forming an emitter in the emitter opening by introducing an impurity which promotes carriers consistent with the majority carrier of the collector region.
3. The method of claim 1 and further comprising the forming of a collector tap from the surface of the substrate spaced from said base region.
4. The method of claim 1 wherein said area of increased collector doping is formed by applying an ion beam to implant appropriate impurities at a depth consistent with the collector to base interface.
5. The method of claim 4 wherein said ion beam is angled with respect to

the surface of the substrate such that the area of the implant is greater than the area of the emitter opening.

6. The method of claim 5 wherein said angle is in the range of 20 to 30
5 degrees from an imaginary line perpendicular to the surface of the substrate.

7. The method of claim 4 wherein the substrate is tilted and turned with respect to the ion beam to obtain the desired angle of implantation.

10 8. The method of claim 5 wherein the angle of the beam with respect to the surface of the substrate is selected to result in the area of increased collector doping to be less than the area of the base opening.

15 9. A transistor circuit formed in a semiconductor substrate comprising:
a collector region having an impurity therein which promotes one of either holes or electrons as a majority carrier, said collector region extending downward from the surface of the substrate which substrate is generally doped with an impurity which promotes the other type of carrier as a majority carrier;
a base region having an impurity therein which promotes the other type
20 of carrier, said base region extending downward from the surface of the substrate into contact with a portion of the collector region;
an emitter on top of said base region and having a surface area smaller than the surface area of said base; and
an area of the collector horizontally adjacent said base region having an
25 increased collector doping, and having an effective surface area greater than the surface area of the emitter opening, but less than the area of the base which is horizontally adjacent said collector.

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